



DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF 500
GT OR MORE (UNLIMITED)

SUBJECT : GENERAL SHIP KNOWLEDGE

DATE : 11.Dec.2023

Time : 0900 to 1200 hrs

Time allowed **THREE hours**

Total marks : 150

ANSWER ALL QUESTIONS

Pass marks : 50%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **not** allowed.

1) a) Briefly explain the uses of Simpson's Rules in ship's stability.
(05marks)

b) The breadths of a ship's water plane 180 m long, at equal intervals from aft, are:
1.5, 7.8, 11.5, 13.4, 14.1, 15.7, 13.0, 11.1, 7.3 & 0 meters

Find the following;

- i. The water-plane area of the vessel
- ii. FWA, if the displacement at this draft is 8500 t in sea water

(20 marks)

2) a) Define followings

- i. Dead weight
- ii. Metacentric Height

(04 marks each)

b) A ship of 15400 t displacement, KG 6.5m carries out cargo operation as follow;

2000t	loaded	KG-5.8m
1100t	loaded	KG-4.8m
900t	loaded	KG-7.0m

She then discharges 600 tonnes of ballast that was at KG 0.8 m, Find how much deck cargo at KG 10m can be loaded so that the KG of ship does not exceed 7 m.

(17 mark)

3) a) State the stability criteria which required to be maintained by the Load Line regulations to ensure the seaworthiness of a vessel. **(12 marks)**

- b) Sketch an unstable vessel (a vessel in an unstable equilibrium) heeled to a small angle (not up to the angle of loll). The sketch should clearly indicate the positions of G, B, M & Z and also show the action of different forces. **(08 marks)**
- c) Describe the possible actions to be taken in case of correcting a vessel which is in an angle of loll. **(05 marks)**
- 4) A vessel arrives at river Thames with a displacement of 12000 t and a draught of 5.77 m. The water density at the entrance to the Hugli River is 1.020. She is to cross a bar up the river before entering Calcutta port. The depth at the bar is 6.0 m and relative density of the water is 1.005. If her TPC is 25, find the minimum quantity of cargo to off load at the entrance to the Hugli River so that she may cross the bar with an UKC of 0.5 m. **(25 marks)**
- 5) a) With an aid of labelled sketches describe the following;
- i. Longitudinally Framed double bottom tank **(10 marks)**
 - ii. Transversely Framed double bottom tank **(10 marks)**
- b) Briefly explain the safety precautions to be taken during welding. **(5 marks)**
- 6) a) Describe different types of marine paints and their usage to prevent corrosion on board ships. **(08 marks)**
- b) Describe briefly how a ship is designed to withstand longitudinal stress. **(08 marks)**
- c) Sketch and explain types of welding faults. **(09 marks)**

Answers

Answer 1(b)(i)

Ordinate	SM	Products
1.5	1	1.5
7.8	3	23.4
11.5	3	34.5
13.4	2	26.8
14.1	3	42.3
15.7	3	47.1
13.0	2	26
11.1	3	33.3
7.3	3	21.9
0	1	0
		256.8

Total area = $3 \times 20 \times (256.8) / 8 = 1926 \text{ m}^2$

Answer 1(b)(ii)

TPC = Area x density / 100 = $1926 \times 1.025 / 100 = 19.74$

FWA = $W / (40 \times \text{TPC})$
 = $8500 / (40 \times 19.74) = 10.76 \text{ cm}$

Answer 2(b)

	Load	Discharged	KG	Moments about keel	
				Load	Discharged
Ship	15400		6.5	100100	
Cargo	2000		5.8	11600	
Cargo	1100		4.8	5280	
Cargo	900		7	6300	
Ballast		600	0.8		480
Total	19400	600		123280	480
	- 600			- 480	
Resultant	18800			122800	

KG after the above operations = $122800 / 18800 = 6.53 \text{ m}$

Assume cargo to load is 'Y' tonnes;

18800	6.53	122800
+ Y	10	+ 10Y

$$\text{Final KG, 7 m} = (122800 + 10Y) / (18800 + Y)$$

$$131600 + 7Y = 122800 + 10Y$$

$$3Y = 8800$$

$$Y = 2933.3 \text{ t}$$

Answer 4

$$\text{FWA} = W / (40 \times \text{TPC}) = 12000 / (40 \times 25) = 12 \text{ cm}$$

$$\begin{aligned} \text{Change of draft} &= (\text{FWA} \times \text{Change of RD}) / 0.025 \\ &= [12 \times (1.020 - 1.005)] / 0.025 \\ &= 7.2 \text{ cm} = 0.072 \text{ m} \end{aligned}$$

$$\text{Depth of water over the bar} = 6.0 \text{ m}$$

$$\text{UKC} = 0.5 \text{ m}$$

$$\text{Max draft to arrive at the bar} = 5.5 \text{ m}$$

$$\text{Change of draft due to RD} = 0.072 \text{ m}$$

$$\text{Max draft on departure Hugli river} = 5.428 \text{ m}$$

$$\text{Draft on arrival Hugli river} = 5.77 \text{ m}$$

$$\text{Required reduction of draft Hugli river} = 0.342 \text{ m}$$

$$= 34.2 \text{ cm}$$

$$\text{TPC at Hugli river} = (25 \times 1.020) / 1.025 = 24.88 \text{ tcm}^{-1}$$

$$\text{Cargo to discharge} = \text{TPC} \times \text{rise}$$

$$= 34.2 \times 24.88$$

$$= 850.9 \text{ t}$$